

Introduction to Radians

In this activity you'll use an eye-catching Sketchpad animation to learn about radians and discover an interesting connection to estimating the value of π .

SKETCH AND INVESTIGATE

1. Open page 1 of **Radians.gsp**.
2. Press the *Animate Points* button. Point *A* will travel along the circle's radius, and point *B* will move along the circle's circumference.

When point *A* reaches the circle's circumference, press the button again to stop the animation. If your timing is off, you can press the *Reset* button and try again.

3. Points *A* and *B* move at the same speed. Select the arc traced by point *B*, and measure its length. It should be equal, or nearly so, to the radius of the circle.

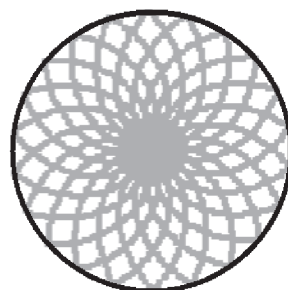
To construct a radian, you sweep out an angle whose corresponding arc length is equal to the radius of the circle. The angle is defined to be one radian.

4. Open page 2 of the sketch. Again, press the *Animate Points* button. This time, let point *B* travel around the entire circumference of the circle. Stop the animation when point *B* returns to *Start*.

Notice that point *A* leaves a trace of its path. Each trip that point *A* makes from the center of the circle and back produces a petal.

- Q1** How many petals are formed during point *B*'s journey around the circumference?
- Q2** Let r be the radius of the circle. For each petal formed, how far does point *B* travel?
- Q3** Based on your answers to Q1 and Q2, how many lengths of radius r (approximately) are traced by point *B* as it moves once around the circumference?
- Q4** Explain why your answer to Q3 makes sense based on the circumference formula, $C = 2\pi r$.

5. Press the *Reset* button to return points *A* and *B* to their original locations.
6. Start the animation again. This time, let the animation run for a while, and watch as point *A* traces a collection of petals. Stop the animation when point *A* has filled the circle with evenly spaced petals. Keep track of how many times point *B* travels around the circle.



To measure the arc length, select **Measure | Arc Length**.

- Q5** How many petals did point A trace? How many times did point B travel around the circle's circumference?
- Q6** Based on your answer to Q5, fill in the blanks in the following statement with integers:
- _____ radii = _____ circumferences
- Q7** Put your statement from Q6 in equation form, letting r = radius and writing circumference as $2\pi r$. Isolate π on one side of the equation.
- Q8** What fraction do you obtain for π ? Is this an exact value of π ? If not, where might the inexactness have occurred?